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Recommended Citation

Knapp, Lesley J.; Bennett, Susan J.; and Brown, Ian M.: An investigation into visual design in the development of educational Web-based projects 2005, 3251-3257.
<https://ro.uow.edu.au/edupapers/563>

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An Investigation Into Visual Design in the Development of Educational Web-based Projects

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Abstract: There is an increasing demand on teachers to use computer technology in their teaching practice, often without support or training to use the technology to its full potential. The study reported in this paper investigated teachers from an Australian government secondary school, involved in a qualitative study into methods of developing visually coherent educational projects for the World Wide Web. The teachers participated in a university funded project, to develop Web-based learning materials for high-school students. The teachers involved in the study developed a project from a multidisciplinary perspective, specifically for the World Wide Web. The perceptions and experiences of the teachers involved in the project were collected as data. The project provided an opportunity to observe the strategies required for developing educational materials for on-line learning in an authentic context with a focus on instructional and visual design.

Introduction

There is an ongoing dilemma facing many teachers who have access to the modern technology but little time to develop the new skills to take real advantage of these mediums. Concurrently, there are increasing amounts of literature on the need to consider the World Wide Web as a visual medium (Kraidy, 2002; Stafford, 1996) requiring visual skills and instructional strategies to take advantage of its potential.

The proliferation of information delivered in formats other than print requires new skills and concepts to make sense of it. The combination of technology and the overwhelming amount of information readily available is creating an unprecedented challenge for educators, as teachers must become proficient with the technology. According to Wheeler (2001) the question is not if or when, but how to adapt teaching methodology to the technology.

Centuries of book-based learning have relegated visual cognition to a subordinate position. However, Kraidy (2002) contends that our culture is evolving largely into a visual culture with the increasing variety of visual representation and graphical computer interfaces. Digital technologies are instrumental in changing a society that is historically text oriented to one that is visually oriented. "[T]he most significant innovation of the computer is the return to a visually based thought process" (Kraidy, 2002, p.103). Traditional methods of instruction are being challenged as unsustainable, "...today's instructional landscape must inevitable evolve or die, like biological species, since its evolution is being radically altered by volatile visualization technologies" (Stafford, 1996a, p.3). In particular, the

World Wide Web has changed the way we communicate from a print-based linear medium to a medium that accommodates colour and images in a non-linear way. Digitised imagery has made it simpler to illustrate concepts with images, colour and shape on a computer screen than in print. To understand however, how visual principles can be incorporated into Web sites, we need to understand more about how teachers create Web-based projects.

The premise for the research is that instructional design principles and visual design skills are interdependent for creating educational resources for the World Wide Web and this paper describes an investigation into visual coherence and visual literacy in the design of on-line learning materials. Kress and van Leeuwen (1996) describe the rules of visual literacy as analogous to the rules for linguistic grammar, and that, as teaching the rules of writing does not inhibit literary creativity, neither will teaching the rules of visual design signal the end of visual arts. The study provided a unique opportunity to document the process of teachers developing Web-based learning material and the problems they encountered as they developed their visual literacy.

Aim of the Study

To become proficient not only with the technology but also with visual design and instructional design, teachers have to develop new skills, however, there is very little information available on how teachers are supposed to gain these skills, and the kind of support they need. According to Tabbers, Martens and van Merriënboer (2004):

The use of multimedia computers in education has led to the development of all sorts of instructional material in which verbal and non-verbal presentation modes are combined. Unfortunately, educational research has not yet identified how to design effective multimedia instructions. (p.2)

This study aims to investigate this gap in understanding the barriers that prevent teachers gaining these skills and identifying what support is required.

The Study

The research project was initiated to observe the process of teachers developing a Web-based project for their teaching practice, using the technology available within the school. Nine teachers from a local high school volunteered for the project as a professional development opportunity. The teachers enrolled in a Faculty of Education postgraduate subject, Teaching Gifted Students – which is part of a Graduate Certificate of Gifted Education and the Masters of Education in Special Education. The certificate was offered to the teachers in return for volunteering for a trial approach to alternative methods of postgraduate study. The teachers formed project teams to create problem-based materials suitable for gifted and talented high school students from a multidisciplinary perspective for the World Wide Web.

This paper reports on the experiences of the first author, who was the primary researcher on this project. A university academic with expertise in gifted and talented education coordinated the project. The researcher's role was as a participant/observer as the study was part of the research project for a Masters in Education by Research. The researcher participated in the project in the role of visual consultant, and observed the project development as part of the data gathering process of a qualitative study.

An investigation into the design of educational materials for the World Wide Web by non-professional designers required an observational research method in an authentic setting. The project took place at the high school to accommodate the time constraints of the teachers. Monthly general meetings were conducted either at lunchtime or immediately after school finished. All individual group meetings were conducted at times convenient to the group members. Data was gathered by observation, journals and individual interviews. The study used a multi-case qualitative approach. A salient point made by Denzin and Lincoln (2000) in reference to qualitative research, is that language, gender, race, ethnicity and social class always moderate the gaze of the researcher. In this study, the researcher was a participant because her background is in graphic and visual design and, as Creswell (1998) points out, a researcher has a paradigm or worldview that will guide the research: "Reality is constructed by individuals involved in the research situation" (p.76).

The Project Design

The project brief was to develop problem-based tasks for gifted and talented secondary school students. Problem-based tasks require 'divergent thinking' having no right answers, multiple possibilities and often involving multiple disciplines. This approach can lead to more meaningful learning as students work co-operatively on problem-based materials and engage in reflection on theory and research through the demands of accomplishing practical tasks. The World Wide Web is advocated as an environment well suited to problem-based learning (Jonassen, Peck & Wilson, 1999; Relan & Gillani, 1997; Sherry & Wilson, 1997; Wilson, 1997), allowing students to explore, analyse and examine viable solutions for 'real life' problems. According to Gallagher, Stepien and Rosenthal (1992) and Jonassen and Reeves (1996), an 'ill-structured' problem should be presented that requires information to fully understand the problem which ensures different perspectives and solutions.

The nine teachers divided themselves into three groups of between two to four people, with each group including teachers from different faculties. The project floundered in the early stages as the teachers had difficulty deciding on themes that were problem-based and multidisciplinary. The teachers held their group meetings at times convenient to their schedules that often meant brief meetings at lunchtime or after school. It was important to the study that the researcher attends all the meetings to observe the processes, interactions and decisions made by the groups. As a participant the researcher was also able to actively intervene to help the project coordinator understand the concerns of the teachers

The researcher had anticipated being involved in each of the projects as a visual design consultant, but it became obvious that strategic intervention was required to get the projects started as everyone appeared to be struggling with how to proceed to develop abstract themes into actual problem-based learning tasks. The teachers were also distracted by technology concerns such as the hosting of the projects, the potential of interactivity and support for Web development and therefore were not concentrating on the design of the project. At this point the researcher needed to redefine her role as a participant in the project, and take a more proactive position. It became apparent that a framework was required to give some form to the project. In response to the concerns raised by the teachers the researcher investigated possible approaches for the project design. By taking a more strategic role, the researcher had a stronger position in each of the groups and this facilitated the interaction between everyone.

A WebQuest template was presented to each of the groups as the framework for the projects, and a step-by-step process and a strategy was developed to identify a problem and a sequence of activities to accomplish a set task. The WebQuest model used was developed in 1995 and:

is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well, to focus on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation (Dodge, 2004, no page).

The researcher arranged a meeting with each of the groups and presented the framework template. This resulted in a positive response from each of the participants. Having a tangible structure with identifiable processes was the key to resolving the confusion. The other aspect that became apparent was the need to make the project relevant to each person's teaching practice. The teachers saw the potential of the project as a platform for future development and this facilitated their motivation and enthusiasm.

The framework was presented as a flow chart with headings for a topic, tasks, resources to research the task, the process to achieve the task and a method of evaluation. Once the flow chart was presented and the decision to concentrate on designing the material based on a WebQuest was made, the project was able to move on. Each of the groups applied themselves to designing problem-based material for gifted and talented students for a Web-based project. By focusing on a statement to introduce the problem, each of the groups was able to develop the tasks and activities for the project.

Each group determined a concept for development based on the areas of discipline of each of the group members as shown in Table 1.

Table 1 Project themes and group description	
Project	Subject areas
<i>Oceans</i> 3 members <i>Oceans as a Source of Recreation, Food and Music</i>	Math and Information Technology Food Technology and Design Technology Music
<i>Connections</i> 4 members <i>Social, Physical and Spiritual Connections</i>	Music Art Japanese and Asian Studies Maths and Information Technology
<i>Ways of Seeing</i> 2 members <i>Different Perspectives in Maths and Art</i>	Math and Information Technology Art

The development of the project for each of the three groups is described in separate case studies.

Description of the Case Studies

Oceans

The theme of the ocean was considered as an environmental theme and one that the students could relate to.

The questions proposed based on this theme were:

- What resources can we get from the ocean?
- How does the ocean sustain us?

The ideas for content generated from discussion were:

- mining gold in the ocean
- music
- medicines
- recreation
- food; all major food groups come from the sea.

This group was the least successful in developing their concept and working collaboratively. Group meetings were cancelled or one member or another was unable to attend. One of the teachers suggested that they work independently and develop five activities each for the task. The maths teacher had difficulty with the concept of problem-based learning because he saw math as having conclusions and answers.

Connections

This group struggled with the concept of a problem-based task for the project, and requested a meeting with the project coordinator. The coordinator wanted the groups to think of global themes and reiterated that multi-disciplined tasks with multiple possibilities needed to be developed. The coordinator suggested the theme of *connections* because links could be made to social, physical and spiritual aspects. She suggested the question: *How will people be connected in 2050?* The researcher facilitated the group's interpretation of the concept of 'Connections' and the group identified four themes for development:

- educational
- social
- spiritual
- cultural

The art teacher in this group was the most effective member and took on the role of leading the group's interactions. Once the group had established a problem for investigation associated with educational, physical, social or spiritual connectedness, they each decided to work on tasks independently related to their disciplines.

Ways of Seeing

This group of two members chose the theme of *Ways of Seeing*. The art teacher used four frames of reference for investigation and analysis, all different 'ways of seeing':

- Postmodernism: appropriated images,
- Structural: semiotics, how an image is organised, use of different mediums.
- Cultural: what it represents
- Subjective: how it affects you; memories, responses, references

The maths teacher in this group investigated:

- fractal geometry; and
- software that uses numbers/maths to create images.

The art teacher in this group was familiar with the WebQuest format and expressed some irritation at the time wasted once it became clear that a WebQuest style was to be used. Once the theme was agreed upon, both the teachers worked independently to research tasks and activities related to their disciplines.

Developing the WebQuests

In response to the participants' frustrations and the need to propel the project along, the researcher suggested that the projects be completed at the end of first session. Once the concepts and a deadline were established, each member was motivated to complete the projects. In order to expedite the development of the concepts into a Web-based project and to fulfil the wishes of the participants to learn new skills using technology, the researcher suggested developing the projects in *Dreamweaver*. A reason for using *Dreamweaver* for the development of the Web project was that schools in NSW have a state licence with Macromedia to use *Dreamweaver* and therefore it is cost effective to purchase. With the collaboration of a senior researcher on the project and the project coordinator, a day was organised for each of the groups to spend at a computer lab at the University of Wollongong for instruction in *Dreamweaver*.

As this was the only opportunity to teach the participants the basic skills in *Dreamweaver* the researcher organised all of the content and graphics from each of the groups into folders on a server ready for input into templates developed by the researcher. The researcher had also sourced some graphics for each of the groups to use in their design. Even though the projects were incomplete, each participant had prepared some content, such as a task or activity for the project. Both the art teachers developed their content using images as metaphors. For example, a graphic of a mobile phone was used as the symbol for the *Connections* project, for its appeal to students and as a device to navigate through the Web site. The teachers from other disciplines developed their content in a text format.

Discussion

The project exposed some of the problems that manifest when designing a Web-based learning project. The teachers were computer literate with a broad range of skills, but were inexperienced in developing learning materials for the Web. If they had developed learning materials for a collaborative project for online learning without the distractions of the technology issues and the emphasis on problem-based learning perhaps they would have had more time to

consider all the aspects of working in a different medium. This project allowed no opportunity to explore issues of visual design, and it is interesting to note, that with all this support, significant assistance was still required, and it was necessary to employ a Web designer to complete the projects so that each of the Websites was a functioning entity.

Common problems encountered by the participants in this project were:

- lack of understanding of the project brief;
- no timeline or deadlines to organise tasks;
- time constraints due to busy schedules;
- difficulty in organising group meetings due to conflicting schedules;
- poor communication between group members;
- misunderstanding of the scope of the project

Each of the groups' understanding of the scope of the project was different. The level of research and development by the *Connections* group was more extensive than the other two groups. Differences in the number of participants in the groups cannot be the only explanation for this as the group of two members worked quickly to identify a topic and research tasks once a framework for the project was introduced.

Once each of the groups decided on a theme, they mainly worked independently of each other to develop the content from their own discipline's perspective. The study also demonstrates how issues of visual and instructional design are sidelined. Both of the art teachers intuitively used images in the development of their part of the projects. However, neither of the art teachers demonstrated knowledge of visual design principles when developing the Web pages.

Historically, graphic designers have been responsible for making information presentable, legible and accessible. There is substantial evidence to support the theory that well presented information not only improves the learning experience but also facilitates deeper learning. Lee and Boling (1999) refer to studies on human memory that show information that is well organised enables the learner to engage with the material and maintain interest in the content. Organised information "facilitates deep processing of important information better than does unorganised material" (p.19). This information is relevant not only to printed material, but to screen design also. Well-designed screens can draw the learner in and motivate the learner to interact.

Conclusion

This study was a pilot study for a further study that addressed the obstacles experienced by the teachers. One aim of the project was to foster collaborative learning within the groups; however, the teachers worked cooperatively in defining a problem-based theme but ultimately focused on tasks and activities independently. A different teaching strategy may have enabled the groups to make more progress. The primary motive for the study however, from the researcher's perspective, was to investigate how teachers addressed issues of visual design when designing educational materials for the World Wide Web. The teachers involved in this study had little opportunity to consider how to incorporate visual design into their projects and the next project was designed to eliminate the barriers and provide supports so that issues of visual design could be considered. The amendments made for the next study are detailed in Table 2.

Table 2 Amendments to the study	
Pilot study	Main study amendments
Participants chose their own groups	Groups formed by Subject lecturer, with a mix of skills and professional backgrounds, including someone with visual design skills, someone with curriculum knowledge.

Project too open-ended	Subject Outline provided details of the project to be accomplished and a deadline.
Project description and outcomes unclear	Project broken up into 2 stages: a design statement; and a Web-based learning activity
Participants concerned about technical issues	Students advised the project was a Web-based learning activity; access to a server was made available to store and share files; tutorials in <i>Dreamweaver</i> and assistance using the program made available
Minimal facilitation by the coordinator	Various methods of communication were available: class meetings, Internet-based class interactions; and Web and e-mail support.

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